Statistical Arbitrage and Information Flow in an Electricity Balancing Market

Derek W. Bunn[a] *and Stefan O.E. Kermer*[b]

In progressing towards more efficient competitive electricity markets, the liberalizing intent has generally been to replace central control with price signals and markets wherever possible. This is becoming the norm in forward, day ahead, and intraday trading, but in the provision of real-time balancing, progress in this direction has been more cautious. Market participants should be obliged to keep to these real-time nominations, either through central control or motivated to do so by the application of penalties on their imbalance volumes. However, it is an open question if further liberalization, involving a relaxation of this obligation in order to permit or even encourage a degree of participant imbalance would be beneficial, and if so, how might market participants manage their operations accordingly.

To motivate our analysis of the benefits or otherwise of statistical arbitrageurs operating in the balancing and settlements process, we firstly record a "natual experiment" in the progressively liberalized evolution of balancing arrangements in the British wholesale market. In 2015, the dual settlement system was changed to a single price, mainly to provide a clearer signal for the provision of flexible reserve capacity and innovative services. The system imbalance volumes for the "non-physical traders" in particular started to increase substantially. Furthermore these non physical traders achieved a profitability of about £10/MWh, or a profit margin of about 20% on the average power exchange prices at the time.

Motivated by this circumstantial evidence, the research in this paper seeks to analyse the potential effectiveness of this statistical arbitrage more formally. We specify optimal decision-making by physical and non-physical participants on the basis of realistic ex ante forecasts. By means of quantile regressions we predict the conditional distribution of the system imbalance and presume that these participants will take optimal expected value positions on deliberate imbalance spillage or shortage. We consider two different players, a physical part-loaded thermal player who has nominated a production schedule before gate closure and who is able to adapt production output and a non-physical player which is a trading company who is active on the wholesale power exchange (EPEX Spot) but does not physically control production or consumption after gate closure. To undertake a back-testing analysis and evaluate the system behaviour based on measured system imbalance data, out-of-sample simulations of the statistical arbitrage trading was caried out.

The standout results are that both the physical and non-physical agents make profits through opportunistic imbalancing. Whilst the actions of the physical player were beneficial in reducing total system costs and therefore welfare enhancing from both producer and consumer perspectives, the nonphysical player's effects were more detrimental to the system. Furthermore, we find a tendency towards short positions for both the physical and nonphysical players, and this is despite the underlying market circumstances that more than 50% of the settlement periods were already short.

The flow of information is a key aspect of the microstructure and trading performance. Therefore, we also studied the effect of information time delays on the stability of the system with time lags between 15 and 120 minutes in contrast to the existing market rules for information flow. We observed that the detrimental system performance of the nonphysical player was due to its

a Corresponding author: London Business School, Regent's Park, London NW1 4SA UK. dbunn@london.edu
b Energy Economics Group, Technical University, Vienna

longer information lag (60mins and more) and furthermore that if the lags can be shortened, it can provide even more system benefits than the physical player.

We conclude that market liberalisation to permit agent optimisation of imbalance positions with timely information below 30 minutes appears to be beneficial to the system as well as for the agents, whether physical or speculative. Furthermore, the case for more timely and transparent information on the state of the system is supported by our analysis.

The market design implication is that consideration should be given to reducing the extra information lags required for non-physical compared to physical players, as this would be highly beneficial. With a well-designed imbalance settlement price settlement process and timely information flows, agents can thus be incentivised to contribute to stabilizing the power-system, and speculation on the imbalance market should not be discouraged.